2001

Growing

STRAWBERRIES IN THE SOUTHEASTERN AND GULF COAST STATES

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GROWING
STRAWBERRIES IN THE SOUTHEASTERN AND GULF COAST STATES

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Strawberry growing is an important industry in certain regions of the southeastern United States. Because of the mild climate, the plants grow almost all year. Flowerbuds are formed during the fall, winter, and spring. Ripe fruit is produced during winter and early spring. The regions covered by this bulletin are shown in figure 1.

Factors that determine a favorable strawberry-growing location are the ripening time of the fruit, transportation facilities, and available pickers. Transportation, supplies, and experienced help are usually available in areas where strawberry growing is a well-established industry.

[1] Retired.

SHIPPING SEASONS

Fruit from the South is usually marketed when there is little competition from other regions. Southern growers ship strawberries to northern markets throughout the winter and early spring. In recent years, increased shipping by truck has replaced shipping by rail.

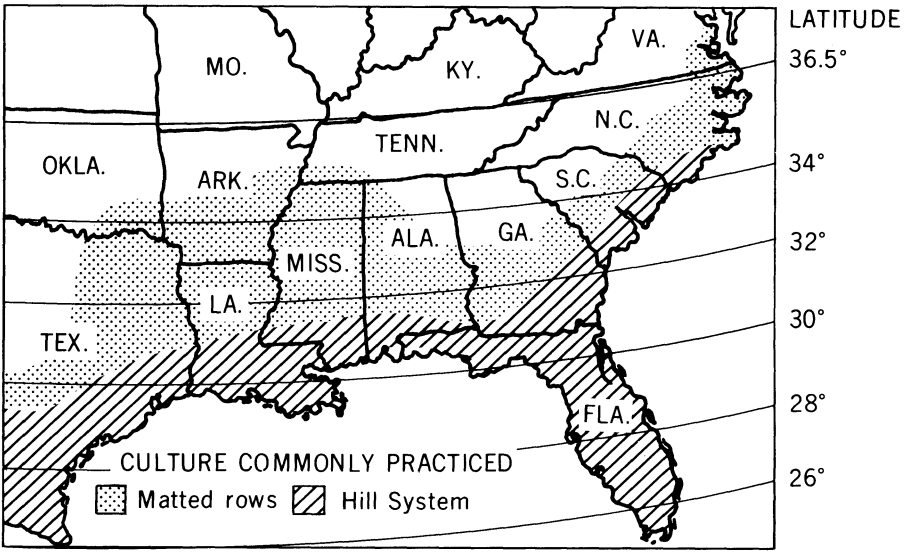

Figure 1.—The regions to which this bulletin applies are indicated by shading.

Figure 2 shows the large centers of strawberry production in the United States and the approximate shipping season in each.

Other things being equal, you should select an area where strawberries ripen at a time that markets are not well supplied from other areas. Figure 2 shows that the strawberry-ripening season in the South advances northward during late winter and spring. Shipments from each area end when berries in the next area are ripe, but a poor crop in one area may provide growers south of that area with a longer shipping season than usual.

Generally the shipping seasons along the Atlantic Coast succeed each other as described below.

The Dade County and Plant City districts in Florida are normally the only source of strawberries for markets in December and January. Shipments from these districts usually are at their height in February when the Starke-Lawtey district in north-central Florida begins to ship small quantities.

In March, shipments from the Starke-Lawtey district become heavier and those from districts farther south become lighter, unless late frosts or other weather conditions retard ripening on northern localities.

In the latter part of April, shipments from North Carolina become heavy and those from northern Florida stop. Shipments of berries from the Exmore, Va., area replace those from North Carolina and are in turn succeeded by shipments from areas still farther north. There are similar successions of strawberry shipments in Louisiana, Alabama, Mississippi, Texas, and other States up the Mississippi Valley.

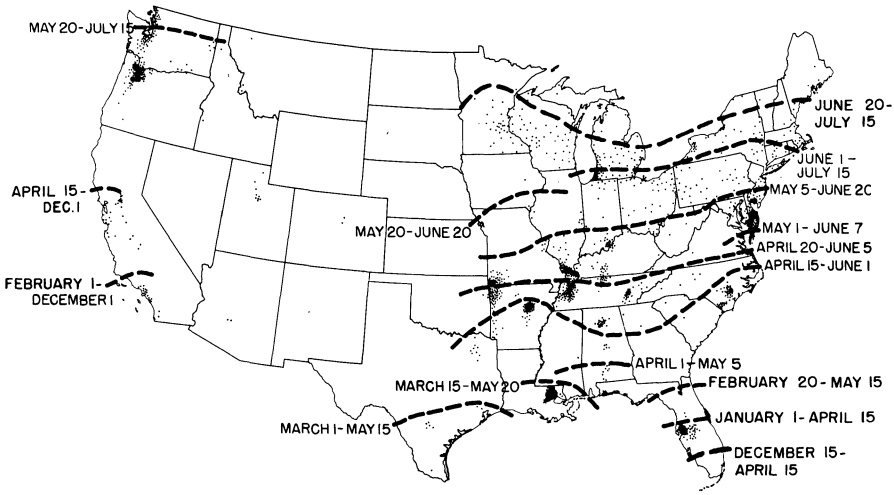

Figure 2.—Dates and broken lines show the approximate ripening season in the major strawberry-producing areas and the northward progression of the ripening season. Dots show the location of large centers of strawberry production.

SUITABLE VARIETIES

Only seven varieties of strawberries—Headliner, Dabreak, Blakemore, Albritton, Florida Ninety, Earlibelle, and Pocahontas—are grown extensively in the South. For a more complete discussion of strawberry varieties see Farmers' Bulletin 1043, "Strawberry Varieties in the United States."[2] Figure 3 shows where each variety is grown.

[2] You can get a free copy from your county agricultural agent or from the Office of Information, U.S. Department of Agriculture, Washington, D. C. 20250. Send your request on a post card. Include your ZIP code number.

Florida Ninety is the leading variety grown in Florida. Headliner is the leading variety within a hundred miles of the gulf coast from western Florida to Texas, and Dabreak and Florida Ninety in the southern part of Texas; Earlibelle, Blakemore, and Pocahontas are the leading varieties northward.

The chief variety in eastern North Carolina is Albritton. Near Exmore, Va., Pocahontas has been a leading variety, but the new Earlibelle and Sunrise varieties are being tested there as well as in all the areas where the Blakemore is grown.

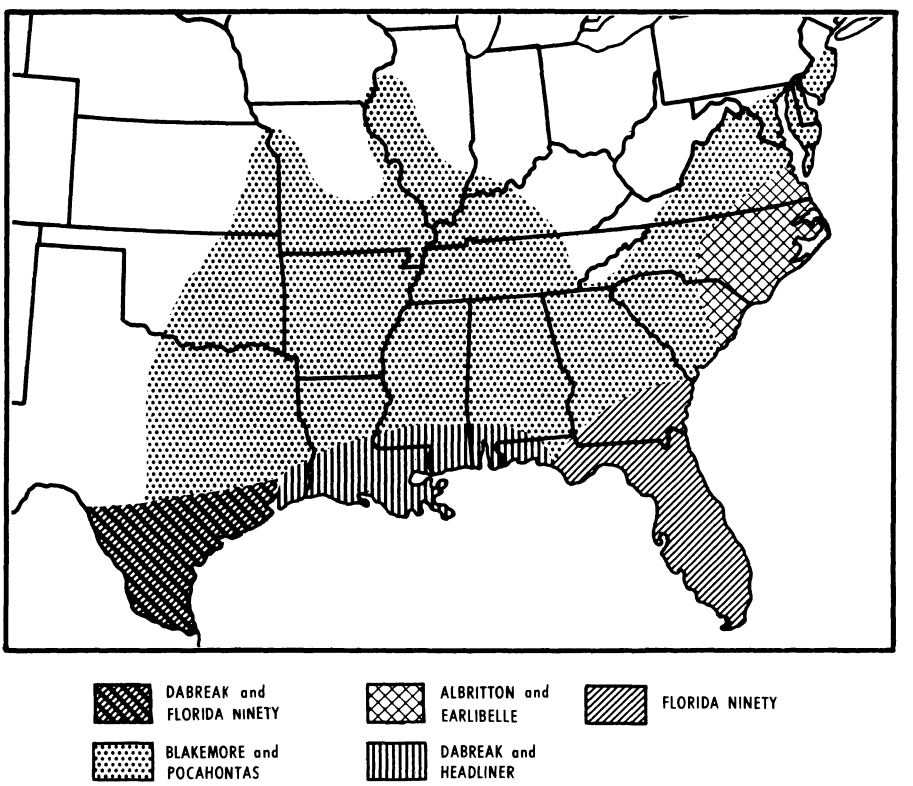

Figure 3.—Where southern strawberry varieties are grown.

GROWTH OF THE PLANT

Healthy strawberry plants set in a moist soil produce new, fine, fibrous roots within a few days. For this reason, you may set them in winter, spring, or fall.

To prevent water loss when you set the plants in the spring remove all the leaves or shade newly set plants with muslin or lattice covers or spray plants frequently with water. New leaves appear almost as soon as the new roots. If the new root system is extensive, the new leaves will be large and healthy.

If, in your area, normally cool weather prevails in late fall or winter, plants should be set with all the leaves retained. Under these conditions, plants with the leaves on them will grow more than do those with the leaves taken off.

If you set plants from about March 1 to April 1, runners appear from buds in the leaf axils in 30 to 75 days and continue to appear until October or a little later. When the days shorten to about 12 hours in the fall, the growing points in the crowns of the oldest and largest plants start changing into flowerbuds.

Daylight periods of 12 hours or less and cool temperatures are very important in flowerbud formation. Each variety may have a different day-length, cool-temperature requirement. Florida Ninety is adapted to the warmest temperatures, Headliner to slightly cooler temperatures, and Blakemore and Albritton to still cooler temperatures. Of these three, Florida Ninety can make flowerbuds under the longest day length. Headliner has a shorter and Albritton a still shorter day-length requirement.

The development of flowerbuds occurs in the oldest and strongest plants first and in the youngest and smallest plants last.

In any plant, the growing point of the terminal crown changes to a flowerbud first, followed by the growing points of lateral crowns. If the plants are growing vigorously, the change may be delayed, but the resulting flowerbuds and berries are larger than on less vigorous plants.

Records of many plants with different numbers of leaves have consistently shown that the greater the number of leaves on a plant late in the fall, the greater the number of berries it will produce.

Figure 4 shows the size of plants with 6, 10, and more than 40 leaves. Every practice should be directed toward obtaining the largest possible individual plants in the fall.

In Florida, flower clusters of Florida 90 appear shortly after the flowerbuds form because plants have practically no rest period. Farther north, the plants become partially dormant and the flower clusters do not appear until February or March. In midwinter, if there is a period of warm weather, followed by freezing weather, the flower clusters that develop in the warm weather may be killed. However, the

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Figure 4.—Plants with (A) 6 leaves, (B) 10 leaves, and (C) more than 40 leaves in late fall. Most fruit is produced on plants with the most leaves.

warm weather that causes flower clusters to grow also enables the plants to develop more flowerbuds to replace those that are killed (fig. 5).

The first flower to open on a cluster is the largest and the first flower develops into the largest fruit. The next flower develops into the second largest fruit, and

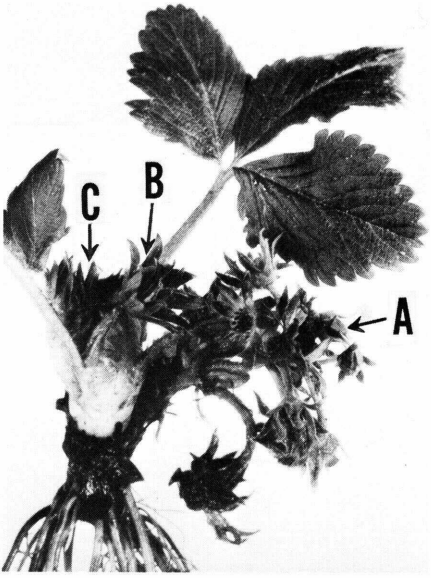

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Figure 5.—A plant with (A) the first cluster of 11 flowers and buds all killed by severe cold but with (B) a second cluster of 9 buds and (C) a third, very small cluster not killed. Weather conditions that induced winter flowering also enabled the plant to develop more flowerbuds to replace those that were killed.

later flowers develop into successively smaller fruit.

The flowers are pollinated chiefly by bees. With moderate weather, the berries mature in about 30 days after bloom. They mature slower in cool weather and faster in warm weather.

In central Florida, the flowering season may be from December 1 to the end of February, or even later in years with cool winters. In North Carolina, the flowering season is 4 to 6 weeks long.

SOIL

No particular type of soil is best for the varieties of strawberries grown in a given area. In Texas, coarse sandy, fine sandy, and heavy gumbo soils are used extensively; in most of Louisiana, a heavy silt loam and sandy loam, but near Hammond, La., a silt loam mixed with sand; in Florida, both heavy silt and coarse sandy loams, but near Plant City, Fla., a black sandy soil. Still other types of soil are preferred elsewhere.

In each section, the type of soil most easily managed and having the greatest content of humus (decaying vegetable matter) is generally preferred.

Drainage

Standing water in poorly drained soil seriously injures strawberry plants and may drown them or so weaken them that their growth is stunted. Soils should be prepared so that water will drain away and not stand.

Drainage is especially important because the land usually is low in strawberry-growing areas in the South. Water often stays on the ground for several days. For this reason the strawberry plants are commonly set on ridges 3 to 12 inches above the furrows that separate them as shown in figure 6. Leaf, root, and fruit diseases occur more frequently on poorly drained sites than where the drainage is good.

Preparation

Land for growing strawberries should be thoroughly prepared. It should contain abundant supplies of humus when the plants are set.

You can supply the humus by applying adequate quantities of manure or by growing and turning under one or more green-manure crops before the plants are set. Legumes such as crotalaria, clover, soybeans, or cowpeas are preferred as green-manure crops.

Use plowing methods that form suitable ridges and furnish good drainage. The height and width of the ridges depend on the character of the soil and on the slope of the field. Ridges 6 to 9 inches above the bottom of the furrows are usually adequate. The width of the ridges varies greatly in different areas. The tops of the ridges are usually leveled with a plank drag before planting. See the section entitled "Planting Systems" for further information.

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Figure 6.—This field has been plowed into ridges for better drainage and has been set to single rows on the raised beds.

OBTAINING PLANTS

Homegrown Florida stocks can be used for propagation in Florida if they are given a cold storage treatment. Plants are dug in early December, cleaned of old leaves, packed in crates lined with polyethylene film or containing damp sphagnum, and placed in cold storage at 32° to 34° F. for about 60 days.

In Florida, because of nematodes and the need for a cold rest period so the plants can produce runners, growers may obtain a limited number of plants each year from northern nurseries. These plants, set during the winter about 3 feet apart in rows about 4 feet apart, serve as mother plants for further propagation.

When cold storage plants or plants from the North are planted in the field in Florida, they are usually handled by the following schedule.

February to March.—Either cold storage plants or new mother plants from northern sources are obtained and set. These should start growing at once.

May and June.—By this time the mother plants set from February to March should have developed enough runner plants to set a larger area of stock plants.

August.—The runner plants from the May and June setting should be ready for planting a more extended area of stock plants.

September and October.—In turn, the plants set in August should have developed large runner plants ready for planting into

the fruiting fields. Florida Ninety plants should be set into the fruiting fields during the first 10 days of October.

The exact time of making the original planting and the transplanting of the runner plants varies with soil and moisture conditions. A field set in February to be used as a propagating bed is shown in figure 7.

By transplanting in May and June, it is possible to obtain enough plants to set a 4- to 5-acre area from a small original stock of 1,000 plants. Moreover, plants raised in Florida and transplanted in this manner will have large crowns. They will bear much more fruit than those brought from the North in October or November and set at once to fruit during the winter. In general, growers have found that it is unprofitable to set northern-grown plants in the fall for fruit production.

16453

Figure 7.—These strawberry plants were brought from the North and set in February. By the first of June they will have made a dense mat of plants that will be used to set a larger propagating bed. The plants grown on this plot will be set on a still larger area in August, and these will produce the plants that will be set in the fruiting beds in October.

In the Louisiana strawberry area, growers propagate their plants from local stock. A part of the old field, which has fruited, is kept free of weeds. The runner plants from this bed are set in the autumn. The mulch in the old bed is removed and the weeds and weak plants are dug out. By November a wide bed of plants should have formed. Some growers transplant the runner plants in July and from this new bed raise plants that are set later to make the planting for fruit production.

Because nematodes are common in Louisiana, the plants should come from fields as free as possible of these pests.

In some parts of southern Texas, plants that are planted for fruit are obtained each year from northern nurseries. Growers who do this believe they get higher yields than from home-propagated plants. In other localities, plants are either propagated year after year from those locally grown or a stock is brought every few years from the North.

Unless home-grown plants are free of nematodes, growers in all areas should obtain their stock from the North each year. The northern stock should be healthy and should be grown in soil free of nematodes. Florida growers have found it necessary to obtain

plants from as far away as Maryland, North Carolina, Tennessee, and Arkansas.

Here are suggestions on how to get plants for districts other than Florida.

Eastern North Carolina, Alabama, Mississippi (except Bay St. Louis), and Tyler, Tex., districts.—Obtain plants in February and March from nurseries or from local fields known to be free of nematodes. Use them to set permanent fields.

Hammond, La., and Bay St. Louis, Miss., districts.—Use either of the following two methods:

(1) *January to March*: Set mother plants from the North. *June 15 to July 15*: Use the best of the runner plants produced by those set from January to March to set a larger area of stock plants. *October to December:* Use the best of the runner plants produced by those set in June and July to set the planting for fruit.

(2) *May*: Cultivate and weed out the bearing field or a part of it immediately after the picking season. *June 15 to July 15:* Use the best of the runner plants from this cleaned area to set a new planting of stock plants. *October to December*: Use the best of the runner plants from the field set in June and July to set the planting for fruit.

In the Hammond, La., area, plants set in November are usually better than plants set at other times, though plants set as late as December 20 may be satisfactory.

Houston, Tex., district.—In December to March, obtain plants from the North in sufficient quantity and set the permanent planting for fruit.

In general, planting seasons have already been indicated. Where growers use the hill system, however, there are some differences. The hill system is discussed in the next section.

PLANTING SYSTEMS

Two systems of growing strawberries are generally used in the South—the hill and the matted-row. Figure 1 shows the sections in which each system is principally used.

Hill System

Under the hill system, plants are commonly set in late summer or autumn and the crop is harvested during the winter or early the following spring. Usually plants set at that time make no runners, but if any do appear, they are removed. When you use this system, you may set the plants in single, double, or triple rows (fig. 8).

Growers generally use the single row in the Hammond, La., district and in the Chadbourn, N. C., district. The plants usually are set about 1 foot apart in rows 3 feet apart. Occasionally the rows are 40 to 42 inches apart.

In most areas of Florida and to some extent in other areas, growers prefer the double row. Where double rows are set in Florida and Lousiana, the rows on each

bed are about 1 foot apart and the alleys between beds are 3 feet wide. With the spacing commonly used, wide beds on which two rows are set allow more plants to the acre than single rows do.

If the drainage is good, three and occasionally four rows are set on each bed in the lower east coast area of Florida and to some extent in Louisiana (fig. 9).

Matted-Row System

Under the matted-row system, plants are usually set in the winter or early spring. Place them 18 to 40 inches apart in rows 3-1/2 to 4 feet apart. The runners are allowed to root. The distance between plants in the row depends on the probable danger of losing plants from drought or insects. If there is little danger, you may set the plants 40 inches or more apart and train the runner plants to form a solid mat in the spaces between plants. Where loss is likely, set the plants about 18 inches apart. Figure 10 shows grades and quantities of strawberries produced under two systems of management.

The matted-row system is commonly used in the Wallace and Chadbourn, N. C., areas; in Alabama; in all the Mississippi areas except Bay St. Louis; and in the Houston and Tyler, Tex., areas. Figure 11 shows a field grown under the matted-row system.

Plants Per Acre

Table 1 shows the number of strawberry plants needed to set an acre when the plants are spaced according to the systems commonly used.

When there is little danger of plant loss, only the number of plants specified in the table will be needed. If there is considerable danger of loss, use a somewhat larger number to insure a full

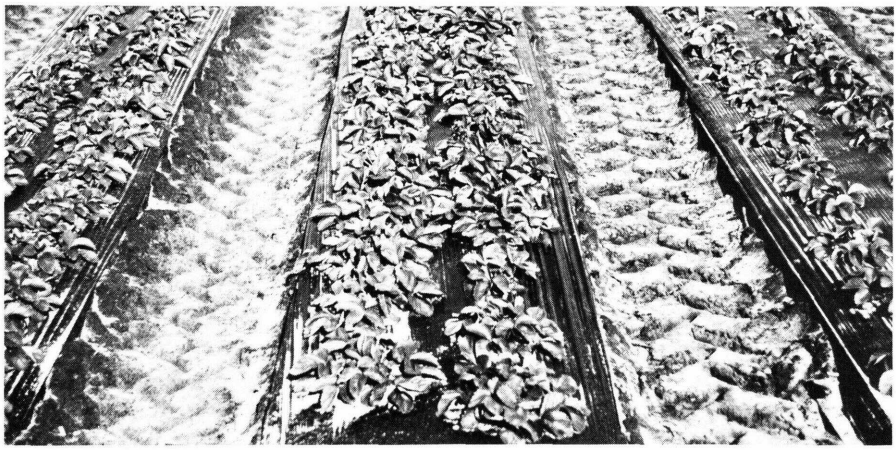

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Figure 8.—Strawberry plants set in double row system with black polyethylene film as a mulch.

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Figure 9.—Strawberry plants set in three rows on each raised bed. This plan is followed in a few areas.

stand. The experience of growers in the area will indicate the number of additional plants needed. The expense of caring for a field that has many blank spaces is out of proportion to the value of the crop. A full stand is necessary for a profitable planting.

Table 1.—*Number of strawberry plants needed to set an acre when spaced at different distances.*

Spacing		Plants to the acre
In the row	Between rows	
Feet	*Feet*	
Double row		
1 by 1⅓	3	20,100
Single row		
1½	2	14,520
1	3	14,520
1	3½	12,446
1½	2½	11,616
2	3	7,260
3	3	4,840
3	4	3,630

CARE OF PLANTS BEFORE SETTING

When plants are received from the nursery, keep them cool and moist until set. If they are to be set the day they are received or the following day, place them in the shade in polyethylene bags. If they cannot be set for several days, open the bundles, separate the plants, and heel them in; or place the entire shipment in cold storage at 32° to 40° F (fig. 12).

When you set plants in the field by hand, you should not drop them far ahead of the setters, especially on dry, windy days. Whether plants are set by hand or by machine, workers should use damp sphagnum or peat to protect the plants from drying.

SETTING THE PLANTS

Set the plants by hand with one of several hand tools, or set them

BN-35383

Figure 10.—A single picking from two rows of Blakemore strawberries to show the difference in grades and quantities produced under two systems of management. The boxes are arranged horizontally by grades: Front row, culls; second row, U.S. No. 1; third row, large; fourth row, fancy. *A*, three boxes containing 2 quarts of berries from a 30-inch-wide matted row (no fancy and but few large berries). *B*, six boxes containing 4 quarts from a double-hill row in which the plants formed early (nearly 1 quart of fancy and 1½ quarts of large berries).

with a machine. A planting machine is cheapest and best for planting large areas. Regardless of the method used, two things are of special importance—setting the plants at the right depth and firming the soil well about the roots.

Figure 13 shows the proper depth for planting. Set the plants so the crowns are even with the surface of the ground after the soil has been packed about the roots. If the soil is not properly firmed, air gets to the roots and they are likely to dry out. The

plants may produce a feeble growth or none. If the soil is thoroughly firmed, you will have little trouble keeping the plants alive.

Some growers step on the soil beside each plant after it has been set to make sure the soil has been properly firmed. When this is done, make sure your foot does not injure the plant.

Setting With Machine

Planting machines that transplant tobacco, tomatoes, cabbage, sweetpotatoes, and other plants in trucking areas are often used to set strawberry plants on smooth land. If the soil is not moist, plants must be watered when they are set.

One man prepares the plants for the machine, another drives the machine, and two others feed plants into the machine. Experienced men can set about 25,000 to 30,000 plants a day.

It is difficult at first to set all the plants at the right depth with the roots straight down when a planting machine is used, but with practice the droppers become expert and learn to set the plants better than by hand. A roller attached to the planter firms the soil. In large plantings on level ground, the machine may be used successfully at a comparatively low cost. This is especially true in areas where the weather is cool and moist for some time after the plants are set. In these areas, frequent irrigation is unnecessary (fig. 14).

Setting With Hand Tools

Growers with small acreages may set plants by hand, using a trowel or punch to open the soil and to press the soil back around

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Figure 11.—Strawberries in narrow, matted rows. They are well grown and are mulched with straw. Under this system plants are commonly set in winter or early spring 18 to 40 inches apart in rows 3½ feet apart. The runners are allowed to root to make a narrow row.

the plants. A workman makes an opening about 6 inches deep, inserts the roots, and presses the soil back.

Two men may work together setting plants with a spade. One man inserts the spade, forces it forward, and opens a slot in the soil. The second man carries the plants and inserts them in the slots. After the roots are inserted, the first man withdraws the spade and presses the soil firmly about the roots with his foot. Plants can be set rapidly by this widely used method.

CARE OF PLANTS AFTER SETTING

Removing Flower Stems

Flower stems usually appear on winter- or spring-set plants soon after they are set. Until the plants become well established after transplanting, fruit production is a severe drain on their vitality; therefore, you should cut off the flower stems as they appear. Early-formed runner plants produce the most fruit the following year, and removal of flower stems helps to get early runners.

Care in Matted Rows

Generally, matted-row beds should not be more than 2 feet wide. Many growers find that rows 12 to 15 inches wide are better still. Berries are easy to harvest from narrow rows, and most varieties of strawberries, especially Albritton, produce better in narrow rows. If the rows are more than 2 feet wide, pickers are likely to overlook some ripe berries along the center. Unless the plants are well spaced, many berries are likely to be small.

Often it is necessary to thin plants in matted rows during the summer and autumn. To do this, roller cutters are attached to a cultivator and all runners extending into the alleys are cut off while cultivating. Surplus run-

BN–35384

Figure 12.—Plants received from the nursery are in bundles of about 25 each.

21940

Figure 13.—Strawberry plants set at different depths: *A*, plant is too deep and will be smothered. *B*, plant set at correct depth with the crown at the surface and the roots straight down. *C*, plant is set too shallow and will dry out.

ners also may be removed when the field is hoed.

Where matted rows are 2 feet wide, growers sometimes run a bulltongue plow, equipped with a point 4 or 5 inches wide, down the center of each row. This is done about the first of September in first-year beds or immediately after harvest in second-year beds. This tears up the center plants and cuts the row into two parts; it then might be called a double-matted row.

STRAWBERRIES AS AN INTERCROP

In some sections, growers plant strawberries as an intercrop in peach, apple, fig, orange, or other tree-fruit orchards.

When the orchard is first planted, strawberries may be set out and grown for several years before the trees need all the ground. The strawberries furnish some income from the land or at least pay the expense of caring for the orchard. The intensive cultivation given strawberries is especially good for young orchards. Because strawberries do not bear well unless moisture conditions are good, strawberries may prove a good indicator of these conditions.

TILLAGE

In the Florida and Louisiana areas, it is necessary to keep down weeds and to maintain the

soil in good physical condition until time of planting. As soon as plants are set in the fruiting field, black plastic mulch is applied and no further tillage is necessary.

In areas outside of Florida, you should begin cultivation immediately after planting. Plants should be tilled each week or 10 days until late autumn or into the winter when the mulch is applied. Because tillage will keep down weeds, no hoeing is usually necessary in the spring.

New leaves grow slowly from the top of the crown, which causes the crown to grow slowly out of the ground. All new roots from the crown grow out at the base of the new leaves. Because dry air kills these new roots, it is important to hoe and cultivate moist soil toward the plants to give the new roots a chance to form.

WEED CONTROL[3]

You can easily control weeds in small home-garden plantings by cultivation and handweeding. The cost of handweeding large commercial plantings is prohibitive, however.

To control weeds economically in commercial plantings, you should consider the use of black polyethylene mulch, soil fumigants, and herbicides combined with mechanical cultivation. The combination of mechanical and chemical control depends on the general cultural practices followed by the grower.

In south Florida, growers place black polyethylene mulch over soil treated with fumigants. Strawberries are space planted through the mulch. Exposed strips of soil between the mulched rows are kept free of weeds with dinoseb spray. Apply dinoseb before flowering, using 3 to 6 pounds per acre on soil area treated. Practically all weeds in south Florida are controlled by this method.

Many annual weed grasses and broadleaf weeds can be controlled with herbicides. Herbicides are effective against most of the more prevalent weeds including crabgrass, goosegrass, lovegrass, annual bluegrass, pigweed, knotweed, chickweed, henbit, lambsquarters, and others.

The time of application for each herbicide depends on (1) the kind of weed problem; (2) the establishment, growth, and development of strawberry plantings; (3) the varieties grown; and (4) the soil composition, climate, and cultural practices. You should get specific local recommendations for using herbicides from your county agricultural agent or State agricultural experiment station.

Apply all chemicals according to the directions on the container label. Some useful herbicides and the weeds they control are discussed here. Dosages are in pounds of active ingredient per acre.

Chloroxuron.—Use 2 to 4

[3] Prepared by L. L. Danielson, plant physiologist, Plant Science Research Division, Agricultural Research Service.

BN-31256

Figure 14.—Setting strawberry plants with machines.

pounds. Apply as a spray on the soil in new plantings after clean cultivation when strawberry plants are well established. Apply after renovation and clean cultivation of beds in the fall. Chloroxuron kills many germinating weedgrasses and broadleaf weeds, including crabgrass, goosegrass, foxtail, chickweed, common purslane, and others.

DCPA.—Use 6 to 9 pounds. Apply as a soil treatment after transplanting or lay-by cultivation. DCPA kills germinating weed grasses and some broadleaf weeds such as chickweed, lambsquarters, purslane, and others.

Dinoseb.—Use 1.5 to 3 pounds. Apply as a spray to the soil between the rows after black polyethylene mulch is placed on the strawberry beds. Avoid drift of the spray onto the strawberry plants. Dinoseb kills germinating and small emerged weed seedlings.

Sesone.—Use 3 to 4 pounds. Apply as a soil treatment 2 weeks after transplanting and after clean cultivation following harvest. Sesone kills germinating annual broadleaf weed seed including henbit, knotweed, lambsquarters, pigweed, and some other germinating weed grasses.

MULCHING

Most growers use a mulch in strawberry fields in the South. The principal uses of a mulch are to keep the berries clean, to prevent decay, to conserve moisture, to protect the flowers from frost, and to keep down weeds.

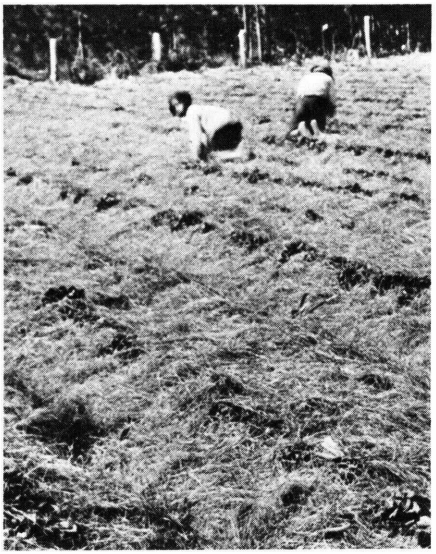
Mulching materials most commonly used in the South are black plastic; pine needles or wild hay; or wheat, rye, or oat straw. All of these mulches are satisfactory.

All commercial acreages in Florida and Louisiana are mulched with black plastic. The plastic mulch is applied when the plants are set or soon after they are set in the plantings for fruit.

Use plastic that is 1 to 1.5 millimeters thick and wide enough to cover the top and sides of the beds. You can apply the plastic just prior to planting and set the plants through the plastic, or you can lay the plastic over the plants after planting and pull the plant tops through slits in the plastic.

When you use pine needles as a mulch, rake them during the winter and stack them along one or both sides of the field until it is time to spread them around the plants. Hay and straw mulches are raked and stacked in summer and fall.

Apply organic mulches just before the blossoms open. Distribute the mulch along the rows from a truck and place it around the plants by hand as shown in figure 15. After the mulch has settled, it should be 1 to 3 inches deep.



BN-4206

Figure 15.—In mulching, straw or wild hay is distributed along the rows from a truck, spread by fork, and placed around the plants by hand.

PREVENTING FROST INJURY

In nearly all parts of the South, frost causes more loss than in most other strawberry-growing regions. Loss of an average of six or seven flowers per plant is not unusual in spaced plantings. Normally, the first flowers to open develop into the largest berries. If you lose six flowers per plant, this represents a loss of 4,000 to 5,000 quarts per acre of the best and earliest berries in a better-than-average field. Losses in matted-row fields probably are less than in spaced plantings because yields in matted rows are smaller.

Growers usually prevent frost injury by covering the plants

with a mulch and by spray irrigation. A light covering of mulch will protect against most frosts. In cool weather, the flowers can be pollinated over a period of several days so you can leave the plants covered 2 or 3 days if frosts are expected on successive nights.

Spray irrigation applied through rotating sprinkler heads is especially effective in preventing frost injury. You can use nozzles with small openings because it takes less water than ordinary irrigation. Start the spray when the temperature drops to 32° F. and continue it until all ice has melted and the temperature is above 32°. Apply the water at a rate of about one-tenth inch per hour. This method of frost control has rapidly increased with irrigation of strawberries (figs. 16 and 17).

BN-35385

Figure 16.—Sprinkler irrigation of strawberry plants for frost protection at blossom time. Note ice on plants.

BN-35386

Figure 17.—Ice on strawberry plants for protection of blossoms from frost. Planting in Louisiana mulched with black polyethylene plastic.

Large power-driven fans are sometimes used for frost protection in low areas. This method of protection is worth considering where conditions are favorable. Oil heaters are effective under some conditions. Growers who think they could use either of these methods should get advice from their county agricultural agent or State agricultural experiment station.

USE OF LIME

In a strawberry field, lime may be useful in several ways. It is a source of calcium, and in the form of dolomite, is a source of magnesium as well. Lime also lessens the acidity of the soil.

Strawberries usually grow well on light soils where the acidity measures pH 5.5 to 6.5. They may grow well where acidity measures

pH 5.0 to 7.0 if there is a great deal of organic matter in the soil.

Where soil acidity is pH 4.5 to 5.3, lime is needed. You should apply 1,000 pounds per acre on light soils to 2,000 pounds per acre on heavy soils. Where the soil is less than pH 4.5, apply 1,500 pounds on light soils to 3,000 pounds on heavy soils.

Lime ties up free aluminum, which is toxic to strawberry plants, and makes calcium and magnesium available. It may also help the tilth of the soil. Apply lime with care because too much will dwarf the plants and reduce the size of the berries. It is best to disk lime into the soil a year or two before the strawberries are planted.

USE OF FERTILIZERS

The principles that apply to the use of fertilizers on other crops generally apply to their use on strawberry fields. Because of differences in soil, the use of fertilizers is chiefly a local problem that each grower must solve.

Nitrogen usually is the most important element in fertilizers applied to strawberries. You may profitably apply nitrogen from early September until December or January.

Because the availability of nitrogen in different fertilizers varies, the source of the nitrogen is important. Nitrogen from mineral sources such as sulfate of ammonia and nitrate of soda is quickly available, but nitrogen from organic sources such as cottonseed meal, tankage, or fishmeal acts more slowly.

Sulfate of ammonia tends to make the soil more acid and should not be used if soil acidity is pH 5.5 or lower. Insufficient nitrogen in the soil results in small crops. Too much nitrogen may result in dense foliage. The dense foliage and shade may make the fruit more likely to rot. Either too little or too much nitrogen may cause the berries to mature late.

On mineral soils in Florida, use 1,400 to 1,800 pounds of 6–8–8 fertilizer per acre or an equivalent amount in other grades. The amount you use depends on whether or not you irrigate. Apply the higher amount when you irrigate and the lesser amount when you do not. Half of the fertilizer should be broadcast and disked into the soil prior to bedding. Apply the other half in a single narrow band in the planting space at time of bedding.

For marl and rock soil, use 1,200 to 1,300 pounds of 6–12–12 per acre, half broadcast before bedding and half banded at time of bedding. If plastic mulch is not applied until 2 to 4 weeks after planting, an additional band of 300 pounds of 5-10-5 per acre may be needed at time of bedding.

In Louisiana, 1,000 pounds of 6–12–6 per acre is recommended. If you do not use an organic mulch, place the fertilizer directly under the area where the plants will be set and then prepare the beds. When you use an organic

mulch, apply half of the fertilizer before planting and the other half in January when you mulch the plants. When you propagate nursery plants, do not fertilize them when you set the plant beds; apply 200 to 300 pounds of 6–12–6 per acre on the beds beside the plants in early September and the same amount again in mid-October.

On the North Carolina coastal plain and similar areas, nitrogen is more important than other fertilizers. On new plantings, broadcast 800 to 1,000 pounds of 8–8–8 per acre and work it into the soil at least 10 days before planting. Follow this a month after planting with 30 pounds of nitrogen per acre on the beds, and in late August or September, apply 40 to 50 pounds more nitrogen per acre.

On light, sandy soils only, apply 30 pounds of nitrogen per acre to new plantings from mid-January to early February. If you apply nitrogen at this time on silt-loam soils, it may cause too much growth and soft berries.

On old plantings being renovated, apply 30 pounds of nitrogen per acre on the beds immediately after harvest, and then follow this with 40 to 50 pounds per acre in August or September.

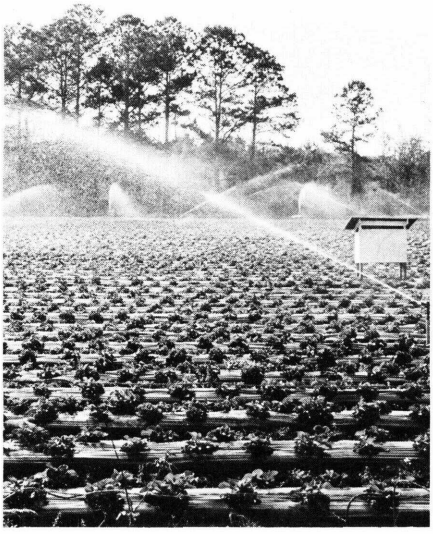
IRRIGATION

Growers generally need to irrigate strawberries because droughts occur often during the long growing season. Serious losses may result. More than 80 percent of growers in Florida and most of the growers in Louisiana use some type of irrigation. Spray irrigation is used most often in Florida and surface irrigation is used in Louisiana and Texas (figs. 18 and 19).

Water for surface, or alley, irrigation is usually obtained from artesian wells in the Hammond, La., area and is pumped from

BN–4209

Figure 18.—Irrigating strawberries during the picking season. Water is run down every other alley. Alternate alleys are left dry for pickers.



BN-35387

Figure 19.—Irrigation of strawberry plants in the hill system. Plants are mulched with black polyethylene.

bayous, streams, and lakes in the Houston, Tex., area. In Florida, growers get water from wells, lakes, and streams. A flowing artesian well provides a continuous water supply. After the well is bored, the only cost is distributing the water.

When drought occurs in summer, growers irrigate to save the propagating beds. They often irrigate to moisten the soil for setting the plants but more frequently to counteract drought during the fruiting season.

In surface irrigation, the alleys should have a slight slope and should be free from obstacles when you apply the water. Water runs down the alleys without waterlogging the soil if the rows are not more than 500 feet long.

During the planting and picking seasons, run the water down every other alley. Workers can walk in the unirrigated alleys. Then water the unirrigated alleys at the time of the next irrigation. If the soil is in suitable condition for working, cultivate the irrigated alleys about 2 days after each irrigation.

RENEWING THE PLANTING

Growers seldom renew a planting under the hill system. It is too costly. They plow it up at the end of the first fruiting season. Under the matted-row system, on the other hand, the cost of renewing is usually less than the cost of setting and caring for a new planting. Where the matted-row system is used, fields are kept 2 to 4 years or as long as they produce profitably.

The length of time a planting remains profitable depends on the natural fertility of the soil and on the prevalence of diseases, insects, or weeds. If plants are badly infested by these pests, you should not renew the old planting. Set a new planting.

If you turn under green-manure crops before you set the planting and if the soil is in good condition, you may harvest two or more crops before you plow up the planting and set a new one. If a field becomes weedy, it may not be worth renewing. Local conditions largely govern the length of time a field is profitable.

When a planting is to be renewed, first cut the tops with a mowing machine. Then the foliage and mulch should generally be turned under or rototilled into

the soil. This will improve the texture of the soil. If the mulch is very heavy, you may remove part of it before plowing.

In all sections where renewing is done try to obtain large, vigorous plants by October when fruit-bud formation begins in much of the South.

Large plants develop in matted rows if you space the plants 8 to 10 inches apart. The amount of thinning necessary depends on the variety and to some extent on the season and the soil.

You may thin the plants by running a spike-tooth harrow or cultivator once or twice across the rows, and once down the rows. This tears up the weaker plants. Use a hoe to further thin the plants if they are still too thick. Under favorable conditions, the plants will develop new foliage within 2 or 3 weeks, and the field will have the appearance of a new planting.

HARVESTING

Strawberries must be handled with great care if they are to reach the market in the best condition. Berries should be picked at least every other day. At the height of the season, it may be necessary to pick berries daily. Do not leave any ripe berries in the field because at the next picking, they will be too soft to ship.

One soft berry in a basket may spoil the entire contents, and one spoiled basket of berries may spoil the looks of a crate by the time it reaches market. The growth habit of the foliage and the differences in growth of different varieties make it more difficult to pick clean in some sections than in others. Dense foliage may hide the berries; therefore, an open growth is more desirable.

Pinch off the stem of each berry when it is picked, and leave about a half inch of stem attached to each berry. Place the berries carefully in the basket; do not throw or drop them. Never leave baskets of berries in the sun, but take them to the packing shed or place them in the shade as soon as possible after picking.

Pickers are paid by the quart. The amount paid varies with the area, with the grade of work done, and with the management plan. Growers may pay the best pickers more than they pay untrained and poor pickers. The extra pay encourages careful work, and the berries are worth more when handled by careful pickers (fig. 20).

The number of pickers to the acre varies greatly. At the height of the season, eight to 10 pickers per acre are sometimes needed in the best fields. On a field yielding an average crop of five hundred 12-pint crates to the acre, five pickers working every day should take care of the crop.

In most areas in the southeastern United States, pickers use wooden or metal carriers that hold 6 quarts. The carrier shown in figure 21 is cheaply constructed and very convenient.

In a field that is tended carefully, there should be very few

BN-35388

Figure 20.—Harvesting strawberries from the hill system in Florida with the aid of a machine to transport the pickers.

berries that are not of the best market grade. Some fields have almost perfect berries, and no sorting is necessary after picking. The best crops are obtained by spacing the plants properly in the row and weeding the field thoroughly. There must be sufficient mulch and humus in the soil to maintain an adequate supply of moisture while the berries are growing and ripening.

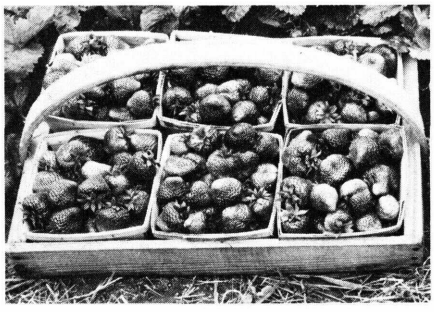


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Figure 21.—Six-basket carrier commonly used in picking berries.

DISEASES[4]

Several diseases attack strawberries at all stages of development from the time plants are set in the nursery beds until fruit is harvested. You can control some diseases by careful selection of planting stock and other diseases by spraying with fungicides. Certain diseases, however, cannot be controlled once they get in a planting.

Try to prevent diseases if possible. Some measures that you can take to prevent and control diseases in strawberries follow—

- Use only plants that are as free of disease as possible; use State-certified plants when available.
- Practice rotation with other

[4] Prepared by J. R. McGrew, plant pathologist, Plant Science Research Division, Agricultural Research Service.

crops; do not plant strawberries after strawberries or tomatoes.

• When diseases are present, spray plants with fungicides in the fall and spring to control leaf diseases, and in spring as soon as flowerbuds appear to control fruit rots.

Some useful fungicides for the control of fruit and leaf diseases are discussed below. Dosages are in pounds of active ingredient per acre. Follow the directions on the container label for each product.

Bordeaux mixture. — Use 0.75 to 2.5 pounds (as metallic copper). It is generally used only after harvest.

Captan.—Use 1 to 4 pounds. It can be used anytime.

Dichlone.—Use 0.2 to 0.4 pound. Do not use within 3 days of harvest.

Dyrene.[5]—Use 1 to 3 pounds. Do not use within 5 days of harvest.

Ferbam.—Use 1 to 3 pounds. Do not use within 14 days of harvest.

Thiram.—Use 1.25 to 3.25 pounds. If applied within 3 days of harvest, wash off residue.

Zineb.—Use 1 to 3.5 pounds. Do not use within 7 days of harvest.

Those diseases that are especially destructive in the South are discussed in the following sections. For a more complete discussion of strawberry diseases see Farmers' Bulletin 2140, "Strawberry Diseases." [6]

[5] Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not mentioned.

Fruit Rots

Several fungi cause green and ripe berries to rot. The most common one is gray mold (botrytis rot).

Besides spraying, a grower can do several things to reduce the amount of rot in a planting. Keep plants well spaced. Do not use nitrogen fertilizer just before harvest. Use a mulch to keep the fruit off the soil and a mulch or sprinkler to protect green fruit from spring frosts that lead to rot.

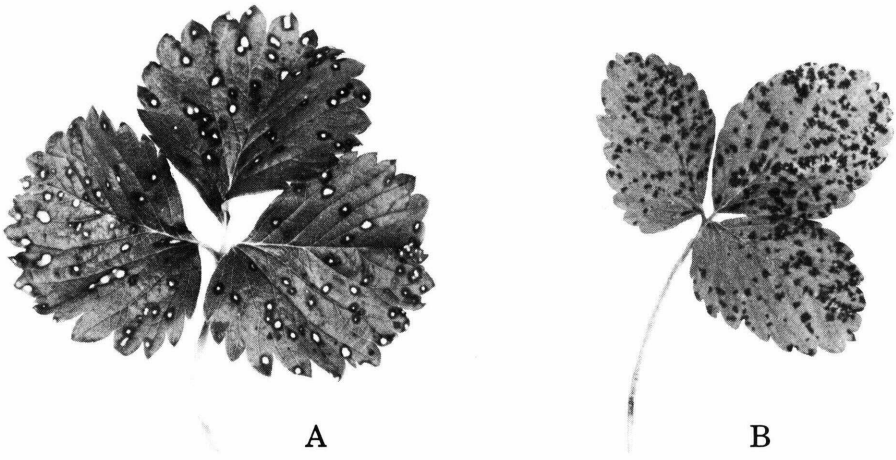
Fungicide sprays applied at weekly intervals from the time flowerbuds first appear in the spring frequently save enough berries from rot to more than pay for the material and labor. The materials most often recommended are captan or thiram.

Leaf Diseases

Leaf spot, leaf scorch, and blight are common strawberry diseases. Under cool, wet conditions in fall and spring, they may destroy enough leaves to weaken the plants and reduce the size of the crop. Varieties differ in their susceptibility to these diseases (fig. 22).

Should any of these diseases appear in a planting, generally good protection is provided by two or three fungicide sprays in

[6] See footnote 2 on page 3.



BN-35389

Figure 22.—A, leaf spot infection on upper side of leaves; spots have purple edges and white centers. *B*, leaf scorch on upper side of leaves; spots are dark purple.

the spring at 1- to 2-week intervals before harvest and one or two sprays in the fall at 3- to 4-week intervals. Any of the materials listed on this page are satisfactory to use.

Root Diseases

Black root rot may be caused by one or a combination of unfavorable cultural conditions, fungi, or nematodes. Plants that have black root rot lack vigor and productivity.

Causes of black root rot are so variable that no recommendations to prevent it can be made here. Your local county agent or State agricultural college may be able to suggest control measures for your area.

Red stele root rot and verticillium wilt are uncommon in the areas covered by this bulletin. Both are more common in cooler climates. Plants with these diseases may wilt and die. Red stele is more severe in wet than dry soils and verticillium wilt is more severe when strawberries follow tomatoes or potatoes in crop rotation.

Crown Diseases

Anthracnose, or crown rot, affects runners and crowns and is most serious in hot, wet climates. Symptoms are black lesions on runners and crowns. When crowns are affected, sudden wilting may occur. Frequently, patches of plants are killed (fig. 23).

This disease organism does not live-over in the soil so the best control measure is to use nursery plants free of the disease. Do not use plants from fields that are infected or that border infected fields.

Rhizoctonia bud rot is most common in hot, moist climates.

BN–35390

Figure 23.—Strawberry plants killed by anthracnose crown infection.

The fungus lives in the soil and may kill young buds. Unhealthy, reddish side buds may grow from affected plants. A severe case of rhizoctonia bud rot may result from cultivation that throws soil on the crowns of the plants.

Virus Diseases

The two general types of viruses that affect strawberries are killer viruses and latent viruses. Killer viruses such as aster yellows produce severe symptoms and kill out individual mother plants along with the attached runner plants. But, generally, very few plants are affected and the overall damage does not warrant control measures. The latent viruses, on the other hand, are frequently responsible for the progressive weakening of a planting stock.

A latent virus by itself may produce no obvious symptoms in a strawberry plant. But combinations of two or more may produce yellow leaves, crinkled foliage, or severe stunting of plants. A single virus may limit the number of runner plants that form and result in low yield and small, dull berries. The only practical thing you can do is replace the planting stock with certified virus-free plants.

When you set out a field of virus-free plants, you should put the new planting more than 1,000 feet from older plantings of strawberries because viruses come only from other strawberries. The spread of viruses in the South by aphids is so limited that the use of insecticides to control aphids is probably not warranted.

NEMATODES [7]

Strawberries are attacked by several kinds of nematodes but the most damaging ones in the South are the root-knot (*Meloidogyne* sp.), bud and leaf (*Aphelenchoides* spp.), lesion (*Pratylenchus* spp.), and sting (*Belonolaimus* spp.) nematodes. Other nematodes such as stubby-root (*Trichodorus* spp.), ring (*Criconemoides* spp.), lance (*Hoplolaimus* spp.), and dagger (*Xiphinema* spp.) occur frequently but usually cause little damage.

All soil-inhabiting nematodes can be controlled by fumigating the soil with nematicides. Nema-

[7] Prepared by J. M. Good, nematologist, Plant Science Research Division, Agricultural Research Service.

todes in roots, leaves, and buds can be killed by the hot-water treatment of plants; immerse the plants in water at 127° F. for 2 to 5 minutes.

All of the nematicides can be used to treat the soil before strawberries are planted. Dibromo-chloropropane is the only nematicide that can be used either before or after planting. However, control is more effective when treatments are used before planting. In general, successful fumigation consists of careful preparation of the soil and application of the correct amount of nematicide at the proper soil depth (fig. 24).

Nematodes, diseases, and weeds can be controlled by treating the soil with methyl bromide, sodium methyldithiocarbamate, chloropicrin, or a mixture of DD and methylisothiocyanate. Equally as good, but for nematodes only, are materials containing dichloropropenes, ethylene dibromide, or dibromo-chloropropane.

Before applying nematicides to a field, consult your county agricultural agent or State agricultural experiment station for suggested materials and methods to

BN-31257

Figure 24.—Effect of fumigation of the soil on the growth of strawberry plants: Left, fumigated; right, not fumigated.

use in your locality. When using nematicides, carefully follow the instructions on the container label. Some of the commonly used nematicides are discussed here. Amounts given for each nematicide are in pounds of active ingredient per acre.

Chloropicrin.—Use 480 to 635 pounds as an overall treatment. Leave in the soil 24 to 48 hours undisturbed. Aerate the soil by cultivating 7 to 14 days before planting.

Dichloropropene (DD, 1,3–D).—Use 230 to 320 pounds as an overall treatment. Leave in the soil 7 days before planting for each 100 pounds of dichloropropene applied. Leave in the soil a week longer in case of heavy rains or if the soil temperature is below 60° F.

Dichloropropene and methylisothiocyanate mixture (DD-MENCS).—Use 145 to 240 pounds as an overall treatment. Leave in the soil undisturbed for 4 to 7 days when the soil temperature is 60° F. or higher and 7 to 21 days at lower temperatures. A plastic tarp or a water seal of 0.5 to 1 inch of water may be used to increase the effectiveness of the treatment. Aerate the soil by cultivating or disking after the exposure period. After aeration, wait 10 to 14 days before planting.

Ethylene dibromide (EDB).—Use 90 to 108 pounds as an overall treatment. Leave in the soil undisturbed for 14 to 21 days before planting or 1 week longer in unusually wet periods.

Dibromo - chloropropane (DBCP).—Use 17.6 to 26 pounds before planting as an overall treatment or 8 to 26 pounds before or after planting as a row treatment. Use on mineral soils only. Do not exceed maximum dosage per acre in a single year. No waiting period is required before planting.

Methyl bromide (MBR).—Use 240 to 435 pounds as an overall treatment. Put a plastic tarp over the soil after treatment and leave it in place for 48 hours. Do not plant for 3 to 7 days after the tarp is removed, or 10 to 14 days longer on heavy or organic soils. Cultivate wet or heavy soils before planting.

Sodium methyldithiocarbamate (SMDC).—Use 124 to 338 pounds as an overall treatment. Irrigate the soil after the nematicide is applied. A water seal of 0.5 to 1 inch of water or a plastic tarp may be placed over the soil after irrigation. Do not disturb the soil for 5 to 7 days; then aerate by cultivating. Do not plant for 7 to 14 days after aerating the soil.

To some degree, all nematodes reduce fruit yield, damage plants and root systems, and cause poor stands and inefficient use of fertilizer and water. Root-feeding nematodes increase the severity of several plant diseases caused by viruses, fungi, and bacteria.

Root-Knot Nematodes

Northern root-knot nematodes (*Meloidogyne hapla*) are the only root-knot nematodes that attack strawberries (fig. 25). These ne-

53106

Figure 25.—Roots of a strawberry plant showing galls caused by root-knot nematodes.

matodes cause small knots on the roots of plants. The knots range from less than one-eighth inch up to one-fourth inch in diameter. Frequently there are several short branch roots above each knot.

In older infections, the knots begin to decay, the root system is greatly reduced, and the roots often appear matted. Plants are stunted, leaves are yellow, and few runner plants are produced. Infections often appear as patches in a field of otherwise healthy appearing plants.

Crop rotation with corn, small grains, grasses, cotton, hairy indigo, and crotalaria will aid in controlling these nematodes. Nematicides also are effective.

Bud and Leaf Nematodes

The strawberry bud nematode (*Aphelenchoides fragariae*) causes the bud disease known as spring crimp, or red plant. Another bud nematode (*Aphelenchoides besseyi*) causes a similar disease known as summer crimp, or summer dwarf, which usually occurs farther south than spring crimp.

These nematodes enter the developing buds from the soil early in the growing season, and symptoms usually appear at the beginning of warm weather. Plants are dwarfed and leaves are small, narrow, crinkled, and dark colored or reddish (fig. 26). Many severely damaged plants die, and less severely damaged plants produce low yields of inferior quality fruit.

Bud nematodes usually live among the developing leaves and buds and feed on the leaf surfaces. During cold weather their numbers decrease, but some remain alive. They can withstand extreme drought and remain alive in the soil.

Symptoms of nematode injury usually appear from July to October. Except in Florida, symptoms disappear during the winter.

All infected plants and connected runner plants in propagating beds and nursery fields should be discarded. Bud nematodes aften are washed out of infected plants by rains and irrigation and carried to healthy plants. You can reduce the numbers of these nematodes, but not eliminate them,

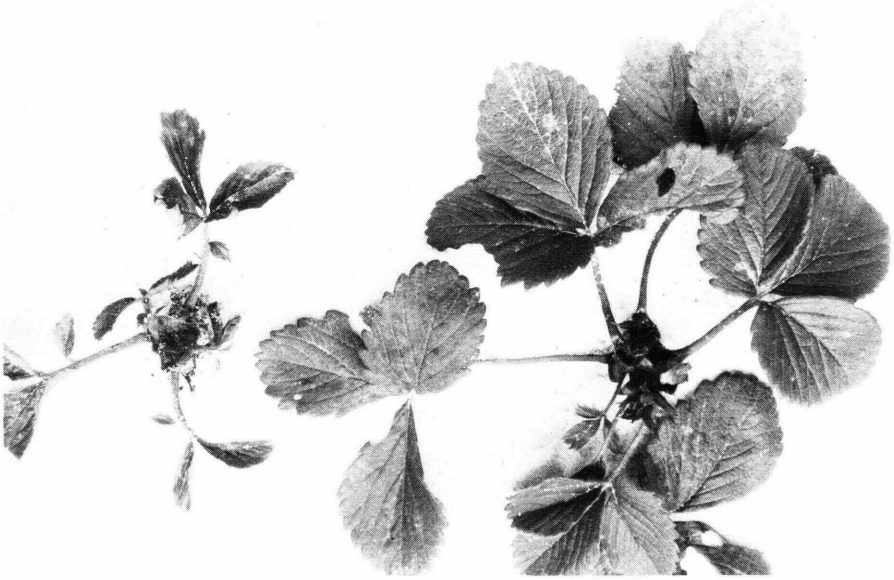


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Figure 26.—Left, plant affected with summer dwarf; right, healthy plant.

if you do not plant strawberries in infected fields for 1 or 2 years.

Lesion Nematodes

At least three species of lesion nematodes attack strawberries. They are common in most fields but damage is frequently unrecognized. They attack the roots and initially cause small, round or elongated spots that are amber to dark brown in color. In older infections, root decay is extensive and is hard to distinguish from that caused by root-rot disease.

Infected plants are stunted and appear in patches in the field. Leafstalk lengths are shortened, leaves may become slightly yellow, and emerging leaves on the most severely infected plants appear bluish. Lesion nematodes increase verticillium wilt in many areas.

Lesion nematodes are hard to control by crop rotation because most cultivated crops are good hosts and sustain or increase the numbers of these nematodes. Oats are the best of the small grains in reducing infestations, but grass sods are more effective than any of the crops. Do not grow strawberries after beans or peas of any kind, nor after legume cover crops such as alfalfa, lespedeza, vetch, or winter peas.

When northern and peanut root-knot nematodes are not a problem, growing peanuts once every 3 or 4 years will help reduce the numbers of lesion nematodes in the soil if the peanuts are harvested. Harvesting the

peanuts removes large numbers of lesion nematodes from the field because these nematodes enter the shells of peanuts more than they do the roots. Lesion nematodes are easily controlled with any of the nematicides listed in this section.

Sting Nematodes

Sting nematodes (*Belonolaimus longicaudatus*) are more destructive to strawberries than any other kind of nematode, but they are found only in the light, sandy soils of the lower coastal plains. They are most common in Florida where they cause high yield losses.

These nematodes are large parasites that live in the soil and feed on roots. They especially damage the growing tips of developing roots. In light infestations, long stringy main roots develop with no small feeder roots. In heavy infestations, most developing roots are permanently damaged and plants have a very limited root system that is best described as stubby-root.

Infected roots have brown spots on them or they become entirely brown, and root tips may be slightly swollen. Plants become stunted and weak, leaf margins turn brown, and some plants may die.

Sting nematodes are hard to control by crop rotation because most crop plants are good hosts and sustain or increase the numbers of these nematodes. In most areas sting nematodes can be controlled by growing peanuts, except in Virginia and North Carolina, where a different kind of sting nematode occurs. Hairy indigo, tobacco, crotalaria, and marigolds help reduce the numbers of sting nematodes. These nematodes are easily controlled with nematicides.

Most grasses, small grains, corn, or cotton should not be grown where sting nematodes are a serious pest.

INSECTS

Many kinds of insects damage strawberries by feeding on the plants or by transmitting virus diseases. Insecticides can be used to control most insects.

Aphids are controlled with endosulfan, strawberry weevils with methoxychlor, spider mites with dicofol, and field crickets and white grubs with chlordane. Follow the directions and heed all precautions on the container label.

For a more complete discussion of insect pests of strawberries, see Farmers' Bulletin 2184, "Strawberry Insects—How to Control Them." [8]

PRECAUTIONS

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

[8] See footnote 2 on page 3.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations.

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